

United States Geological Survey

Programs in New Hampshire



The USGS provides maps, reports, and information to help others meet their needs to manage, develop, and protect America's water, energy, mineral, and land resources. We help find natural resources needed to build tomorrow, and supply scientific understanding needed to help minimize or mitigate the effects of natural hazards and environmental damage caused by human activities. The results of our efforts touch the daily lives of almost every American.

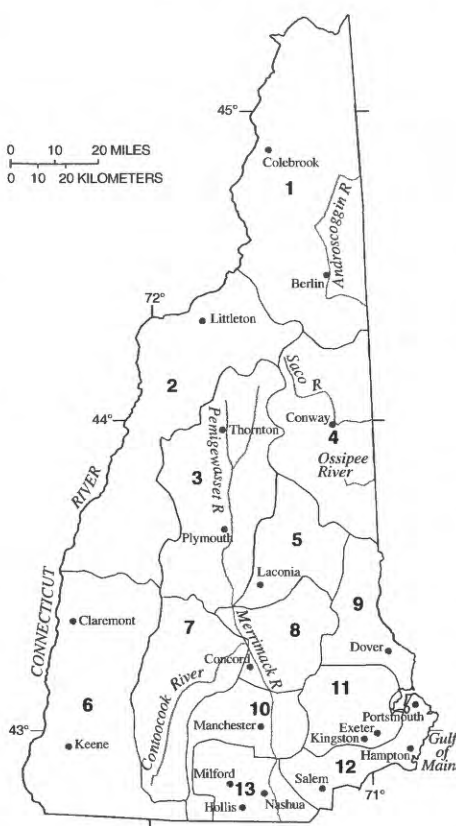
For over 100 years the U.S. Geological Survey (USGS) has been assessing, mapping, and reporting on New Hampshire's earth resources. Ongoing USGS programs in New Hampshire include investigations of ground water, ground-water flow in fractured bedrock, water quality, hazardous-waste sites, lake-water quality, "red tide" in coastal waters, topographic and geologic mapping, water use, and hydrologic data collection. Through each of these programs and its cooperative efforts with State, local, and other Federal agencies, the USGS contributes to the health, safety, and economic well being of New Hampshire's citizens every day.

Ground-Water Investigations

Increases in population and development in New Hampshire have created an increased demand for water supply. Towns and communities are interested in developing additional ground-water supplies and in protecting existing water resources for the future. Chapters 361 and 402 of the State statutes passed by the New Hampshire State Legislature in 1983 directed the development of expanded water-resources information to support economic growth and wise management of the resource. The New Hampshire Department of Environmental Services, Water-Resources Division, has entered into a long-term cooperative program with the USGS to assess the State's ground-water resources. Under this program, the USGS has been identifying the State's stratified-drift aquifers and describing the areal extent, geohydrologic properties, potential yield, and quality of water in these aquifers.

These studies have resulted in a series of maps and reports that cover 13 areas

throughout the State (fig. 1). The maps show the extent, saturated thickness, and transmissivity of stratified-drift aquifers. The reports include descriptions of the aquifers, stratigraphic-log data, and esti-



EXPLANATION

— Boundary of study area

Study areas

- 1 Upper Connecticut/Androscoggin
- 2 Middle Connecticut
- 3 Pemigewasset
- 4 Saco/Ossipee
- 5 Winnepesaukee
- 6 Lower Connecticut
- 7 Contoocook
- 8 Upper Merrimack
- 9 Cochecho
- 10 Middle Merrimack
- 11 Lamprey/Exeter
- 12 Coastal/Merrimack
- 13 Nashua

Figure 1. Ground-water-investigation study areas in New Hampshire.

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mates of the potential yield of major aquifers.

As the stratified-drift aquifer assessment nears completion, the focus of the program is shifting to an assessment of the State's bedrock aquifers. This phase of the program is designed to identify areas of potentially high-yielding wells in bedrock and to analyze the quality of the water in those areas. The major bedrock fracture traces in New Hampshire are being mapped and related to the yields of wells to assess the water-supply development potential of bedrock aquifer sites. The quality of water from the aquifers also will be assessed to assist communities and State planners in the identification of potential water supplies.

Research on Ground-Water Flow in Fractured Bedrock

Recent trends in New Hampshire show that an increased number of bedrock wells have contaminated water. To protect ground-water supplies in bedrock aquifers and to remediate contaminated water sources, an understanding of ground-water-flow processes in fractured bedrock is essential. The influence of rock types,

rock fractures, and structure of the bedrock system on ground-water flow through bedrock is being studied in the Mirror Lake drainage basin near Thornton. This project is funded by the USGS Toxic Substances Hydrology program.

Geologic Mapping

Surficial geologic mapping, which is done in cooperation with the New Hampshire Department of Economic Resources and the Department of Environmental Services, has produced detailed maps that show the distribution of sand, gravel, silt, clay, and till, mostly in the southern one-half of New Hampshire. In this part of the State where population growth has been rapid, an overview map of the sand and gravel resources at the 1:250,000 scale also has been produced. These maps have been used extensively by State and local planning agencies and consultants in addressing environmental issues related to water supplies, waste disposal, construction of highways, and building development.

National Water-Quality Assessment Program

In 1991, the USGS began a full-scale National Water-Quality Assessment (NAWQA) Program. The objectives of the NAWQA Program are to describe the quality of large, representative parts of the United States's surface- and ground-water resources and to identify the primary natural and manmade factors that affect the quality of these resources. The program provides information that is useful to water-resource policymakers and managers at national, State, and local levels. Data for evaluation of surface- and ground-water quality, river-bed sediments, and aquatic organisms will be collected.

Two NAWQA Program studies are underway in New Hampshire. The Northern New England Basins study unit encompasses an 18,600-square-mile area that includes central and eastern New Hampshire, western and central Maine, and northeastern Massachusetts; in New Hampshire, this area includes the drainage basins of the Merrimack, the Androscoggin, and the Saco Rivers, as

well as several small coastal drainage basins. The Connecticut River and Long Island Sound Coastal Rivers study unit encompasses a 15,750-square-mile area that includes western New Hampshire, eastern Vermont, west-central Massachusetts, most of Connecticut, and small parts of New York and Rhode Island; in New Hampshire, this area includes the drainage basin of the Connecticut River.

The NAWQA Program is providing information related to the following issues: the presence and distribution of toxic substances in surface and ground waters; the effects of land use and releases of treated wastewater on surface-water quality; the contribution of upland sources to downstream contaminants in coastal waters; the presence of high concentrations of naturally occurring trace elements and radon gas in some aquifers; the occurrence of synthetic, organic-chemical contamination in surface and ground waters; and the relation of fish and aquatic-insect communities to upstream land-use practices.

A local committee of representatives from Federal, State, and local agencies; universities; and the private sector works closely with the USGS in each NAWQA Program study to exchange information on regional and local water-quality issues and to assist in designing and planning project products to meet the needs of the States and towns in the study units.

Hazardous-Waste-Site Investigations

The USGS is conducting geohydrologic and surface-water investigations for the U.S. Environmental Protection Agency (USEPA) at a number of hazardous-waste sites in New Hampshire identified under the Comprehensive Environmental Response, Compensation, and Liability Act. The most intensive activity is at a site in Milford. The USGS has been working at this site since 1989 to assess ground-water flow in the aquifer. A ground-water-flow model of the study area has been developed.

At other sites throughout New Hampshire, the USGS provides technical assistance and consultation to the USEPA on problems related to ground-water hydroau-

tics, surface-water monitoring, water-quality sampling, and analysis of hydrologic systems. Technical assistance has included studies at the Gilson Road site in Nashua, a former plating company site in Merrimack, and the Country Pond site in Kingston. Stream gaging at Gilson Road, water-quality sampling at Country Pond, and geophysical and ground-water-flow investigations continue at the well site in Milford.

Lake Water-Quality Investigation

Development of the watershed and shoreline of Flints Pond in Hollis has led to accelerated nutrient (nitrogen and phosphorus) loading of the pond. Dense growth of milfoil and other aquatic plants has reduced the recreational use of the pond. The New Hampshire Department of Environmental Services (NHDES) is conducting a nutrient budget study as an initial step in developing a remediation plan to improve the usability of the pond by shoreline residents.

The USGS, in cooperation with the NHDES, Water Supply and Pollution Control Division, is characterizing the ground-water-flow system in an area surrounding the pond, which is fed primarily by ground water.

Contaminated Sediments in the Gulf of Maine

Many types of contaminants ultimately are deposited in sediments where they may adversely affect commercial and recreational use of marine resources. This study is assembling available data on contaminants in sediments to assess contaminant levels and transport pathways in the Gulf. The data base is used to create maps of contaminant distribution; to provide information to local, State, and Federal regulatory agencies; and to address specific questions about the transport and long-term fate of contaminants in the waters of New Hampshire, Maine, and Massachusetts. Preliminary maps indicate that "halos" of elevated contaminant concentrations commonly are in marine surface sediments for tens of kilometers offshore from urban or industrial centers.

The study is being conducted by the USGS in cooperation with investigators from regional academic institutions and is partially supported by the National Oceanographic and Atmospheric Administration's Regional Marine Research Program.

Sources, Transport, and Nutrient Environment of Toxic "Red Tide" in the Western Gulf of Maine

Blooms of a toxic red microorganism (*Alexandrium tamarense*) have become a serious economic and public health problem that affects nearshore and offshore shellfish, fish, and marine mammal populations in the Gulf of Maine. This is known as "red tide," which has expanded in recent years to affect more areas and more fisheries resources. It can be managed most effectively if the hydrodynamic, nutritional, and biological mechanisms that underlie the microorganism's population development are understood. This project uses a combination of numerical modeling, hydrographic and biological measurements, moored and drifting current measurements, and satellite imagery to quantify the structure, variability, and mechanics of the coastal current in the western Gulf of Maine. The study area extends from Penobscot Bay in the north to Massachusetts Bay in the south. USGS scientists are testing the hypothesis that a source population of algae in southern Maine is carried southwestward along the coast in a buoyant coastal plume. The distribution of the plume is determined by wind stress, runoff, and general water circulation in the Gulf of Maine. Some of these blooms may enter Massachusetts Bay, and others may continue along the coast across Stellwagen Bank and onto Georges Bank. This study will provide a quantitative understanding of the physics, biology, and chemistry of the regional red tide phenomenon. In addition, this research is providing data useful for developing a numerical model that can be used by managers concerned not only with toxic algae, but also with long-distance transport of dissolved and particulate contaminants. This work is conducted by the USGS in cooperation with investigators at the Woods Hole Oceanographic Institution,

Oregon State University, and the University of New Hampshire and is partially supported, in part, by the Gulf of Maine Regional Marine Research Program.

National Mapping Program

Among the most popular and versatile products of the USGS are its topographic maps at the scale of 1:24,000 (1 inch on the map represents 2,000 feet on the ground). These maps depict basic natural and cultural features of the landscape, such as lakes and streams, highways and railroads, boundaries, and geographic names. Contour lines are used to depict the elevation and shape of terrain. New Hampshire is covered by 212 maps at this scale, which is found to be useful for civil engineering, land-use planning, natural resource monitoring, and other technical applications. These maps have long been favorites with the general public for outdoor uses, including hiking, camping, exploring, and back-country fishing expeditions.

Hydrologic Data Collection

A basic program of water-data collection has been established to monitor the amount of water in rivers, streams, lakes, reservoirs, and aquifers in New Hampshire. These data are used for forecasting; water-resources planning; design and operation of projects for water supply, hydroelectric power, flood control, and pollution control; designing bridges and culverts; flood warning; flood-plain management; and hydrologic research. Long-term records are needed to evaluate the responses of hydrologic systems to natural climatic variations and human-induced stresses so that potential problems can be defined early and appropriate planning and management actions can be taken by local and State agencies.

In New Hampshire, surface-water data are collected from a network of 32 continuous-record streamflow stations, 1 continuous-record lake-stage station, and 18 partial-record streamflow stations. The ground-water-monitoring network provides monthly water-level data at 24 wells. These networks are operated by the USGS in cooperation with the New Hampshire Department of Environmental Services, Water Resources Division. Sur-

face- and water-quality data, collected throughout the State (fig. 2), are used routinely by private consultants, residents, newspapers, colleges and universities, and local government agencies throughout the State.

Water-Use Information

Water resources in New Hampshire are increasingly stressed by new demands. Competition for water necessitates that available supplies be matched with existing and future demands. Data on water use and availability are needed by decisionmakers to resolve critical issues related to water supply, hydropower, snow making, water quality, and the potential effects of streamflow withdrawals on ecosystems. The USGS, in cooperation with the New Hampshire Department of Environmental Services, is providing water-use information for the management of New Hampshire's water resources. USGS assistance is provided in the collection, analysis, and dissemination of water-use data. A data base is being developed, and a water-use atlas for



Figure 2. Water-quality data-collection sites in New Hampshire.

New Hampshire was distributed to State and Federal agencies, educators, consultants, and other organizations concerned with water resources.

Earth Observation Data

Through its Earth Resources Observation Systems Data Center near Sioux Falls, South Dakota, the USGS distributes a variety of aerial photographs and satellite image data products that cover New Hampshire. Mapping photographs of some sites go back about 40 years. Satellite images dating from 1972 can be used to study changes in regional landscapes.

Geologic Information Centers

The National Earthquake Information Center (NEIC) in Golden, Colorado, collects, processes, and distributes information from more than 20,000 seismic events each year. This information is distributed in the form of alerts, bulletins, and routine catalogs to emergency-management officials at Federal and State levels, operators of critical facilities, news media, the general public, and the earthquake research community. These catalogs of recent and historical earthquake information are used in earthquake-hazards assessments. To fulfill its mission better, the NEIC has developed and is deploying the U.S. National Seismograph Network (USNSN), which, when com-

pleted, will consist of approximately 60 seismograph stations nationwide. The USNSN currently (1995) has a station in Lisbon. The USNSN monitors nationwide seismicity, provides early notification of seismic events to national level emergency-services personnel, maintains an archive of high-quality digital data on national seismicity, and provides public information on earthquakes.

The National Landslide Information Center (NLIC) in Golden, Colorado, is the focal point for collection and dissemination of information on significant landslide events, critical research results, and public policy issues relating to landslides. The NLIC collects and distributes a vast amount of information related to landslides to users throughout the world.

Marine Research Center

The USGS conducts a wide range of geological and geophysical research and mapping investigations of the continental margins of the United States and around the world through its office in Woods Hole, Massachusetts. From this office, marine scientists carry out investigations primarily along the U.S. Atlantic Coast and in the Gulf of Mexico, the Caribbean Sea, the Great Lakes, and polar regions. These marine geologic studies are designed to identify environmental problems and geologic hazards in offshore

areas and to assess critical nearshore processes that affect erosion, wetland loss, and polluted sediments. These studies also increase our understanding of the Nation's energy and mineral resources and document the past record of climate change. The long-range goals of the research and mapping efforts are to provide a comprehensive body of knowledge of the geology, history, and processes of the continental margins and to develop a predictive capability to guide and assess the consequences of the use of these margins.

Cooperative Programs

The USGS cooperates with many Federal, State, and local agencies. Cooperative programs include agreements with city and town governments and regional planning commissions. A few examples not referenced above are the cities of Keene and Rochester; the towns of Conway and Lincoln; the Nashua Regional Planning Commission; the New Hampshire Department of Environmental Services, Waste Management Division; the U.S. Department of Defense; the U.S. Navy; and the U.S. Forest Service.

The USGS provides support to the New Hampshire Water Resources Research Institute, which conducts a program of research, education, and information and technology transfer.

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Additional earth science information can be found by accessing the USGS "Home Page" on the World Wide Web at "<http://www.usgs.gov>".

For more information on all USGS reports and products (including maps, images, and computerized data), call 1-800-USA-MAPS.